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AUTHOR Biglan, Barbara
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ABSTRACT

Included in this module are four activities dealing with issues of solid waste disposal relative to urban concerns. Included activities are: (1) sources and composition of solid waste; (2) a "garbage game"; (3) disposal options for solid waste; and (4) an example county plan for solid waste disposal. Also included are an overview, teacher background information, an activity preview, a pretest, and a module evaluation form. (RE)

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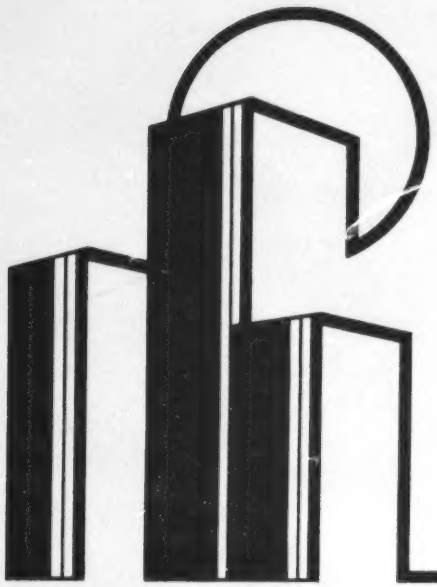

Curriculum Module VI

Urban Environmental Education Project

Solid Waste: Trash or Treasure?

developed by Barbara Biglan

SE 030 517

ALLEGHENY INTERMEDIATE UNIT

Instructional Support Services
Suite 1300, Two Allegheny Center
Pittsburgh, PA 15212

Dr. Harold E. Oyer, Executive Director
Dr. Therese T. Walter, Assistant Executive Director
Dr. Daniel R. Nicholes, Director of Citizenship Education

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URBAN ENVIRONMENTAL EDUCATION PROJECT

Curriculum Module VI

Solid Waste: Trash or Treasure?

developed by

Barbara Biglan

August 1979

Catherine Combleth, Curriculum Series Editor
University of Pittsburgh

Solid Waste: Trash or Treasure?

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Solid Waste: Trash or Treasure?

OVERVIEW

Our throwaway society may be coming to an end. In the decades after World War II, fuel and raw materials were so cheap and plentiful that it was often more economical to throw away used products than to recycle them. Clean air and water were secondary concerns. Today, solid waste presents a serious problem to the quality of life in our urban environments, in part because most of the disposal methods result in some type of environmental damage. These methods of getting rid of waste not only cause pollution problems but they are expensive. Every year cities in the United States spend almost 5 billion dollars to collect and dispose of solid wastes. We cannot afford to continue our present methods of garbage disposal.

A growing mountain of trash threatens to bury us as well as others around the world. Solid waste is a problem for each one of us. While the quality of our lives is enhanced by many products made of aluminum and plastics, for example, these very products represent serious solid waste disposal problems.

How can we maintain our high standard of living without burying ourselves in trash or polluting our urban environment beyond repair? How can we dispose of our solid waste in an environmentally safe way? The economics of soaring energy prices, raw material scarcity, and environmental concerns have turned local planning commissions to recycling or energy recovery. How economical is recycling in dollars and energy use? How might we conserve resources and produce less trash in the first place? In our future, will solid wastes be considered trash or treasure?

This module explores where our garbage comes from and how we dispose of it. Before trash can be turned into treasure, each person must be aware of his or her contribution to the solid waste problem. After a consideration of disposal options, students examine the proposal offered by Allegheny County solid waste planners. This presents an opportunity for students to participate in a current phase of decision-making in their immediate communities.

Solid Waste: Trash or Treasure?

TEACHER BACKGROUND INFORMATION

On the average, every man, woman and child in the United States disposes of more than 7 pounds of solid waste (garbage, trash, or refuse and sewage) each day of the year. This adds up to an enormous amount. In one large city in the United States, for example, 25,000 tons of garbage a day are thrown away. Garbage includes all kinds of things: food wastes, newspapers, cans, bottles, old clothing, abandoned cars, and broken toys. In fact, almost everything that is produced is eventually thrown away in one way or another. The amount of garbage we produce is increasing each year. It is threatening to bury us.

Garbage is usually disposed of by dumping it on the land or in the sea, filling in the land, or burning it to ashes in incinerators. Each of these disposal methods has its drawbacks. Dumping spots breed disease and rodents. We are running out of suitable land for filling. Burning garbage contributes to air pollution.

It is time to stop our wasteful habits. Solid wastes present a serious challenge to the quality of life in our urban environments because most methods of disposal result in some type of environmental change. Further, solid waste disposal is expensive and is becoming more costly each year. Government regulations also affect the means and cost of waste disposal. For example, all open dumps must be eliminated by 1985, and dumping of sewage sludge into oceans is to end by 1982. As a result, items as diverse as old bottles, aluminum cans, abandoned cars, feedlot manure, and household garbage are being recycled or

reused instead of going into garbage dumps, littering the landscape, or polluting the environment. For example:

1. Of the approximately 200 million tires discarded each year, some 10 million or 1 out of 20 are recycled or reused. A Goodyear Tire and Rubber Company plant in Akron, Ohio burns old tires with coal to generate steam.

2. Two dozen waste-processing plants, after extracting reusable materials such as metals and glass, burn garbage to produce steam or process it to make solid fuels. Another two dozen plants are under construction.

3. Perhaps the best known program is the recycling of aluminum cans. Some 750,000 Americans collect recyclable cans, and in 1978 aluminum companies paid nearly $53 million for 7 billion used cans.

Solid waste disposal questions include collection costs, treatment costs, public and industrial cooperation, and energy use. To what extent can our present trash ease the energy crisis? How can our solid wastes be recycled to the benefit of our urban environments?

Annotated Bibliography

City and Town. March, 1979.
This magazine deals with city management problems. The March 1979 issue contains articles on sewage disposal, crankcase oil recycling at the University of Rhode Island, and Kansas City, Missouri's use of collected waste. An objective evaluation of solid waste disposal is part of each article. Although this magazine is far too technical for the students, it is a good resource for teachers.

Hahn, James, and Hahn, Lynn. Recycling: Re-using Our World's Solid Wastes. New York: Franklin Watts, 1973.
This book explains recycling, our need of it, and present and suggested methods of reusing waste materials. There are sections on reclamation of paper, glass, and metal. Suitable for students in grades 5-8.

Holary, D. S., Jr. The Energy Trap. New York: Four Winds, 1975.
In addition to a detailed treatment of the energy crisis, this book contains a section on "wasted solids." The process of pyrolysis or energy recovery is discussed in terms of equivalent barrels of oil. Although this book is technical in sections, it is an excellent reference.

Simon, Seymour. Science Projects in Pollution. New York: Holiday House, 1972.
A good book for the middle grades, this source contains sections on air, water, and land pollution. The experiments do not require elaborate equipment, and directions are easy to follow.

Simons, Robin. Recyclopedia: Games, Science Equipment and Craft from Recycled Material. Boston: Houghton Mifflin, 1970.
This book presents arts and crafts ideas for materials usually discarded or available at recycling centers. Geared for grades 4-7, this book serves as a valuable classroom aid to recycling discussions and projects.

United States Steel. Turning Trash into Cash. (P.O. Box 86, Pittsburgh, PA 15230), 1979. (available free on request)
This attractive, 15 page pamphlet outlines solid waste problems and alternative responses with an emphasis on resource recovery. A chart, illustrated diagram, and suggestions for citizen action are included.

ACTIVITY PREVIEW

This module consists of four activities. Each activity is intended for a minimum of 45 minutes of class time. Supplementary activities also are suggested; their use would increase the class time needed.

Activity 1. Solid Wastes: Where Do They Come From?

In this activity, students identify sources of solid waste from a personal standpoint -- what did I throw away yesterday? The past (1900) to present (1970's) tonnage of solid waste is compared to promote discussion of the change in product and container use that has occurred.

Activity 2. The Garbage Game

This is a game activity. The Garbage Game board has two sides. One is the garbage production side, the other is the disposal side. The game reviews sources of waste and introduces various disposal methods.

Activity 3. Solid Wastes: What Are the Disposal Options?

Explanations of recycling, open dumping, incinerating, landfill, chemical treatment, and energy recovery are provided in this activity. Environmental criteria are presented, and students are asked to rate each disposal method in terms of the criteria.

Activity 4. One County's Dream for Disposal

This activity introduces the Allegheny County master plan for waste disposal. From the information provided, students identify a quality of life goal, examine alternatives, and justify or disagree with the decisions made by planners in Allegheny County.

NOTE: A knowledge pretest for students, reprinted on the following pages, is provided in the Student Materials Packet.

Solid Waste: Trash or Treasure?

MODULE VI PRETEST

1. The largest source of solid waste is

   a. sewage.
   b. agriculture.
   c. mineral production.
   d. homes.

2. On the average, each person in the United States produces how much solid waste per day?

   a. 1 pound
   b. 7 pounds
   c. 1 ton
   d. 25 pounds

3. The tonnage of solid wastes from agriculture is less than the tonnage of wastes from

   a. manufacturing.
   b. homes.
   c. sewage.
   d. mineral production.

4. The most common method for disposing of solid waste is

   a. burning.
   b. recycling.
   c. landfill.
   d. open dumps.

5. The process of incinerating waste can cause

   a. air pollution.
   b. water pollution.
   c. land pollution.
   d. both air and land pollution.

6. Landfills can best be used for

   a. large office buildings.
   b. parks.
   c. farmlands.
   d. homes.

7. By 1985, the Federal Government will outlaw all

   a. open dumps.
   b. incinerators.
   c. sewage treatment plants.
   d. chemical recycling.

8. The process of burning garbage to create usable energy is called

   a. energy incineration.
   b. energy conservation.
   c. energy recovery.
   d. energy crisis.

9. Recycling materials like aluminum cans, old tires, and paper has gained popularity because

   a. too much garbage is unsightly and smells bad.
   b. these resources are becoming scarce and more costly.
   c. people can make art objects from trash.
   d. old tire swings are fun.

10. The ideal solid waste disposal plant would

   a. recycle all materials.
   b. create new sources of energy.
   c. provide for recycling and energy recovery.
   d. create new parks and playgrounds.

ACTIVITY 1. Solid Wastes: Where Do They Come From?

Objectives: In this activity, students identify sources of solid waste, compare past and present waste tonnage, and hypothesize possible explanations for the increase in solid waste production.

Organizing Ideas:

1. Everyday, every person creates some waste material that must ultimately be disposed of.
2. The major sources of solid wastes in the United States are agriculture, mineral (or chemical) production, manufacturing (or industry), municipalities (homes), and sewage (from business, industry, homes).
3. As population, industry, and energy production grow, so does waste production.

Resources:

Holary, D. S., Jr. The Energy Trap. New York: Four Winds Press, 1975.

Simon, S. Science Projects in Pollution. New York: Holiday House, 1972.

Student Materials:

Handouts (provided in the Student Materials Packet)

Solid Wastes: Where Do They Come From? (SM 1.1)

Sources of Solid Waste, 1978 (SM 1.2)

Solid Wastes Produced in the United States (SM 1.3)

Suggested Procedures:

1. The first part of this activity, SM 1.1, focuses students' attention on the fact that we all produce garbage or solid waste. (Technically, solid waste includes both garbage or refuse and sewage.) The left-over milk in

the breakfast cereal bowl enters the sewage system; the empty cereal box awaits weekly pickup. In classrooms, the circular file or garbage can gathers paper and apple cores among other things. (If you are certain nothing "filthy" or "slimy" will emerge from your room's trash can, you might have students empty it onto old newspapers and make a list of its contents.) After students have completed SM 1.1, a class garbage list might be written on the chalkboard. (Later, students can organize their garbage list using the categories presented in SM 1.2 and/or determine how to best dispose of each type of trash.)

2. The circle graph, SM 1.2, shows where our nation's solid wastes come from. The amount of "home" or municipal garbage is relatively small while mineral waste is largest. (This suggests yet another side to energy issues.)

3. From the line graph, SM 1.3, it can be seen that solid waste production has escalated dramatically since the mid-1940's. Discussion of these data might include consideration of questions such as:

   a. How have our ways of living changed in the past 30-40 years (since World War II)? (For example, more throw-away products and packages, greater energy use; also, wooden and metal toys were more often repaired than thrown away, compared to today's plastic ones. In addition, there are more people using more products.)

   b. Why might people be more concerned about solid wastes today than they used to be? (For example, more people producing more wastes living closer together in cities; greater concern with environmental quality.)

   In order to obtain additional information (to verify their hypotheses), students might interview an older neighbor or relative, or they might consult library references.

4. In addition, students might be asked to consider how we can conserve resources and produce less garbage. (For example, consider the packaging of common products such as soaps, toothpaste, and candy bars.)

Solid Wastes: Where Do They Come From?

From the moment you were born, you have been a S. W. P. (Solid Waste Producer). When your baby clothes were washed, detergent suds were left. When you didn't finish your cereal, solid waste was produced. It has been estimated by the Environmental Protection Agency that each of us produces 7.4 pounds of solid waste (garbage and sewage) per day.

Let's check on the solid wastes you produced yesterday (or any typical day). Starting with the time you got up in the morning, make a list of everything you threw out. Also try to remember everytime you turned on a water faucet -- the water going down the drain enters a sewage treatment facility. Try to think of at least 10 things. (Do NOT throw out this paper!)

1. _____ 7. _____

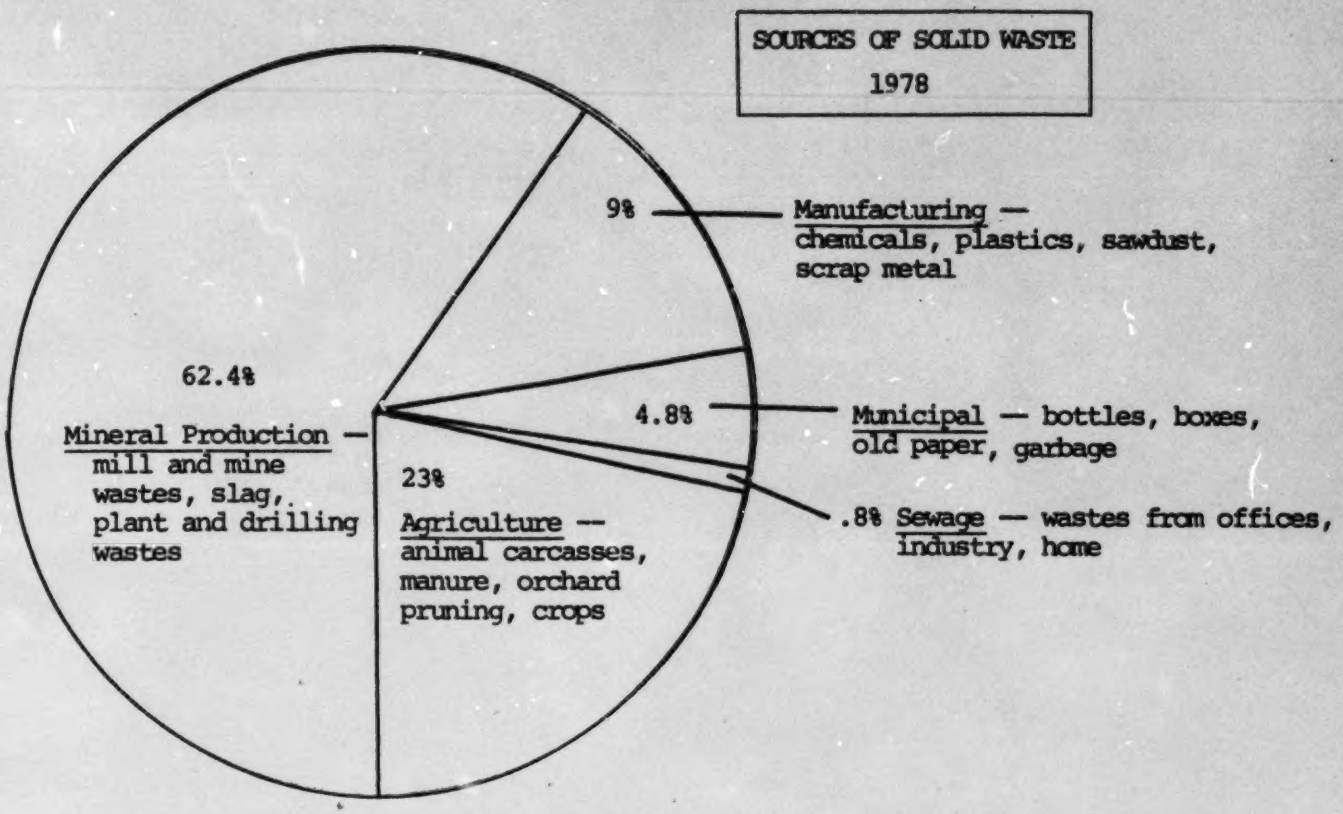
2. _____ 8. _____

3. _____ 9. _____

4. _____ 10. _____

5. _____ 11. _____

6. _____ 12. _____


SOURCES OF SOLID WASTE
1978
9%
Manufacturing — chemicals, plastics, sawdust, scrap metal
62.4%
Mineral Production — mill and mine wastes, slag, plant and drilling wastes
4.8%
Municipal — bottles, boxes, old paper, garbage
23%
Agriculture — animal carcasses, manure, orchard pruning, crops
.8% Sewage — wastes from offices, industry, home

1. What is the largest source of solid waste?

_____

2. Which produces more solid waste, agriculture or manufacturing?

_____

3. To which source of solid waste do you contribute most?

_____

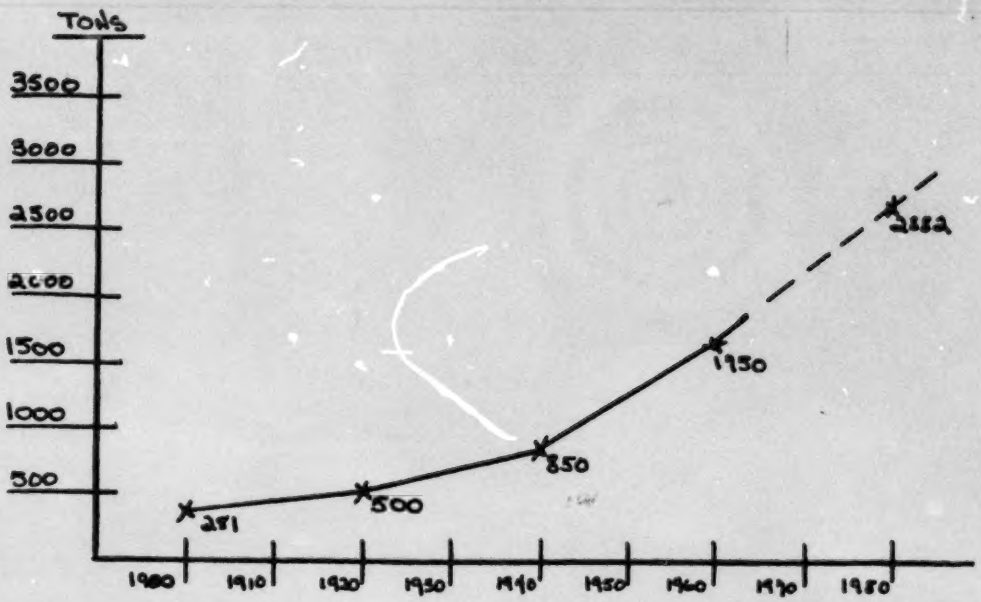
4. We need coal, oil and natural gas for energy. Coal mining produces waste material. To which source of solid waste does coal mining contribute?

_____

5. To which source of solid waste does drilling for gas or oil contribute?

_____

Solid Wastes Produced in the United States



1. From 1900 to 1920, what was the increase in tons of solid waste?

   _____

2. From 1940 to 1960, what was the increase in tons of solid waste?

   _____

3. From 1960 to 1980, there will be an estimated increase of 1250 tons of solid waste. During which 20 year period is the increase in solid waste greatest?

   _____ 1900 to 1920; _____ 1940 to 1960; _____ 1960 to 1980?

4. What is different about the products you use today and the ones your parents used 10 or more years ago?

   _____

   _____

5. What might be some of the causes of the rapid growth in solid waste production?

   _____

   _____

ACTIVITY 2. The Garbage Game

Objectives: This is a game activity, which reviews the sources of waste and introduces disposal methods. The Garbage Game board has two sides, one for production and the other for disposal. After playing the game, students should be able to list sources of solid waste and methods of disposal for each.

Organizing Ideas:

1. The major sources of solid waste in the United States are agriculture, mineral (or chemical) production, manufacturing (or industry), municipalities (homes), and sewage (from business, industry, homes).
2. The major methods of solid waste (particularly garbage) disposal are open dumping, landfill, incineration, recycling, energy production (recovery), and chemical treatment.

Resources:

City and Town. March 1979. (Most issues contain at least one article on solid waste disposal and/or recycling.)

Hahn, J., and Hahn, L. Recycling: Re-using Our World's Solid Wastes. New York: Franklin Watts, 1973.

Student Materials:

Garbage Game board (provided in the Student Materials Packet -- can be mounted or laminated for re-use)

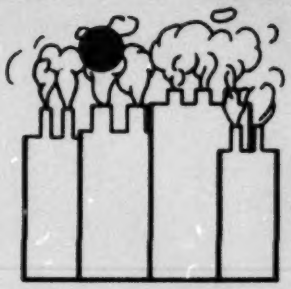
Collection Sheet (provided in the Student Materials Packet)

One die or spinner

Markers (buttons, pieces of colored paper)

Suggested Procedures:

1. The game may be played by individuals or teams of two-three students. First, students collect tons of garbage by moving around the game board. Tonnages of garbage collected are entered on a collection sheet. (The percentage of tons of garbage in each category corresponds with current national production, as noted on SM 1.2.) After all players have finished collecting garbage, the board is turned over and the disposal part of the game is played. As players move around the board and land on disposal spaces, tons of garbage are crossed off their collection sheets. However, each disposal possibility can only be used to get rid of certain kinds of waste. For example, sewage can only be disposed of by means of chemical treatment; municipal, industrial, and agricultural wastes all can be recycled. (Disposal limitations are noted on the collection sheet.)
2. Part II of the Garbage Game, disposing of the garbage collected in Part I, might be played after Activity 3, which involves examination of waste disposal options.



Sewage 25 Tons | Home 25 Tons | Industry 50 Tons | Chemical 100 Tons | Agriculture 50 Tons | Chemical 50 Tons

Home 25 Tons | Industry 25 Tons | Agriculture 50 Tons

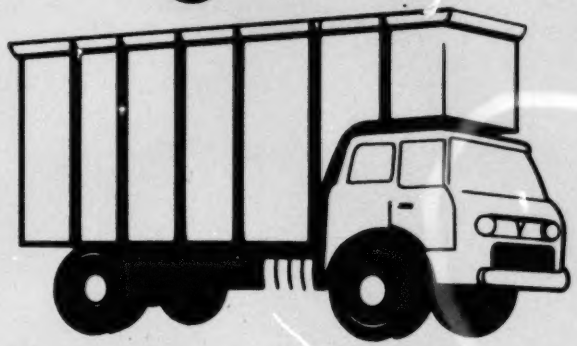
Chemical 50 Tons

Agriculture 50 Tons

Home 25 Tons

Industry 25 Tons

the garbage game



Agriculture 50 Tons

Home 25 Tons

Industry 25 Tons

Chemical 50 Tons

Industry 25 Tons

Agriculture 50 Tons | Chemical 50 Tons | Home 25 Tons | Chemical 50 Tons | Industry 25 Tons | Agriculture 50 Tons

Industry 50 Tons | Sewage 25 Tons | Chemical 50 Tons | Home 25 Tons | Agriculture 50 Tons | Industry 25 Tons | Chemical 50 Tons | Agriculture 50 Tons

to disposal operations

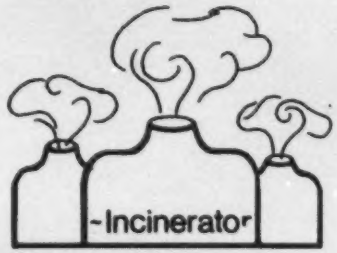
Agriculture 50 Tons

Chemical 50 Tons

Industry 25 Tons

Chemical 50 Tons

	Recycle 25 Tons	Incineration 50 Tons	Landfill 50 Tons	Chemical Treatment 50 Tons	Recycle 25 Tons	Gas Production 25 Tons	Incineration 25 Tons	
Recycle 25 Tons	Chemical Treatment 50 Tons	Incineration 25 Tons	Recycle 25 Tons	Production of Electricity 50 Tons	Landfill 25 Tons	Incineration 50 Tons	Landfill 25 Tons	Recycle 25 Tons	Landfill 50 Tons
Incineration 50 Tons									
Landfill 50 Tons									
Gas Production 100 Tons									
Incineration 25 Tons									
Landfill 25 Tons	Open Dump 50 Tons	Chemical Treatment 50 Tons	Incineration 25 Tons	Recycle 25 Tons	Production of Electricity 25 Tons	Landfill 50 Tons	Incineration 50 Tons	Open Dump 25 Tons	Recycle 50 Tons



Incineration 100 Tons	Landfill 50 Tons
	Gas Production 50 Tons

Can you dispose of all the solid waste?

GARBAGE GAME
Collection Sheet

Source	Tons of Waste (List each amount collected in a separate space.)								
Homes - Municipalities									
Industry - Manufacturing									
Mineral - Chemical Production									
Agriculture									
Sewage (all types)									

Disposal Options

Open Dump - any waste

Recycle - home, industrial, and agricultural wastes only

Incineration - home, industrial, agricultural, and mineral-chemical wastes only

Landfill - home and mineral-chemical wastes only

Chemical Treatment - sewage only

Energy Recovery (Production of Gas or Electricity) - any waste

ACTIVITY 3. Solid Wastes: What Are the Disposal Options?

Objectives: In this activity, students examine different methods of disposing of solid wastes and compare (the advantages and disadvantages of) the various disposal options.

Organizing Ideas:

1. Current methods of solid waste disposal include open dumping, landfill, incineration, recycling, energy recovery (pyrolytic conversion), and chemical treatment.
   a. In environmental terms, open dumps are the most offensive method of disposal.
   b. Sanitary landfill offers advantages over open dumps, but does present other problems. The same is true of recycling, incineration and chemical treatment.
   c. The "trash power" of pyrolytic conversion needs further research and development but does hold promise for our energy future.
2. Each municipality within Allegheny County has its own disposal plan for solid wastes. (Some haul their waste to various landfills, some incinerate, and a few locales still permit limited open dumping.)

Resources:

ALCOA (Aluminum Company of America) Technical Center/Lab, 412/339-6651. Materials about recycling can be requested for school use.

GRIP (Group for Recycling in Pittsburgh), 250 North Highland Mall, Pittsburgh, PA 15206, 412/661-4447. Speakers are available to talk about recycling projects and legislation.

Hahn, J., and Hahn, L. Recycling: Re-using Our World's Solid Wastes. New York: Franklin Watts, 1973.

Holary, D. S., Jr. The Energy Trap. New York: Four Winds, 1975.

Simons, R. Recyclopedia: Games, Science Equipment and Craft from Recycled Material. Boston: Houghton Mifflin, 1970.

United States Steel. Turning Trash into Cash. Pittsburgh: U.S. Steel, 1979.

Student Materials:

Handouts (provided in the Student Materials Packet)

Solid Wastes: What Are the Disposal Options? (SM 3.1)

Disposal Options Fact Sheet (SM 3.2)

Environmental Score Card (SM 3.3)

Suggested Procedures:

1. After reading about the journey of the soda can and the test paper, SM 3.1, encourage students to list their possible destinations as indicated in the story and any others that they know of.
2. The activity continues with an examination of these disposal options. (Waste disposal is used here to refer to collection and recycling or disposal.) A fact sheet, SM 3.2, briefly describes six methods of solid waste disposal. Additional information can be obtained from the references listed under Resources and from local agencies (e.g., borough or township managers (or engineers), leaders of recycling organizations such as GRIP -- Group for Recycling in Pittsburgh).
3. In completing the "Environmental Score Card" for waste disposal options, SM 3.3, students summarize information and identify benefits and drawbacks of each method of disposal. Review and, if necessary, explain the criteria.

Note that #1-4 are considered drawbacks and that #5-8 are considered benefits. (A plus or minus might be indicated after each criterion.) Encourage students to add other criteria that they believe are important (e.g., visual appearance). Then, ask students to indicate (with an X) whether each criterion applies to each disposal option, referring to the Fact Sheet, SM 3.2, as needed.

4. On the basis of the "Environmental Score Card" summaries, ask students to select a "best bet" for solid waste disposal and explain the reasons for their choice -- in either a group discussion or an individual position paper. Alternatively, point values might be assigned to each option (+1 for each benefit, -1 for each drawback) and the results reviewed and tallied by the class as a whole. (Note: At this point, students might return to the class garbage list compiled in Activity 1 and decide how best to dispose of each type of trash.)
5. Since local municipalities have different methods of solid waste disposal, students might find out what method is used in their community. For example, a small group of students might compose a letter to their township or borough manager in which they ask about local solid waste disposal practices and regulations. Alternatively, students might plan and carry out a phone interview or a personal visit to municipal offices. For City of Pittsburgh information, call the Environmental Services Department at 412/255-2341.
6. Optional small group or whole class field trip activities include:
   a. ALCOSAN (Allegheny County Sanitary Authority), 3300 Preble Avenue, 412/766-4810.

A tour of the facility can be arranged, geared to the age level of the students.

b. Creative Recycling, 4614 Liberty Avenue, 412/687-0900.

The Creative Recycling group can also arrange to come to your school with a program and more information about their center.

c. A "pick-up" field trip along a local roadway or in a local park.

Large plastic trash bags can be designated for different materials, e.g., glass, aluminum cans, paper, scrap metal. Call GRIP to find out the latest prices for aluminum and glass. Use the waste paper in an experiment to make recycled paper in the classroom. (See Simons, R. Recyclopedia: Games, Science Equipment and Craft from Recycled Material.)

Solid Wastes: What Are the Disposal Options?

Solid Waste Producer, welcome to the journey of some friends of yours. An empty soda can and that test paper from school are about to be disposed of. Their first resting place is in the garbage can. (We will not litter!) As their journey begins, there are many different paths open to them. The can and paper could be dumped. Ugh — the smell, the rats and cockroaches — a dump is not a pleasant journey's end. A better resting ground is a landfill. Here the can and paper can finish off their lives. The paper has a few weeks to live, but the can will live 400 years or more. The can and paper could both have been burned in an incineration plant. Then they would be nothing more than ashes and soot, perhaps on your clothes, car, house, and even in your lungs. How about recycling? The old can can be used to make a new can; the old paper can be made into new paper. Recycling sounds good. Or, the can and paper could be burned to produce steam which in turn would produce electricity. That empty soda can could really light up your life!

List the things that could happen to the soda can and the test paper.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

Disposal Options Fact Sheet

1. City dumps or open dumps are the oldest form of waste disposal. Dumps are unpleasant to look at, smell bad, pollute water supplies, and can cause disease by attracting mosquitoes, flies, rats and other rodents. Open dumps are, however, inexpensive. Gradually, the materials left in the dump will decay.

2. Sanitary landfills are organized dumps. Wastes are packed by tractors or other heavy equipment and then covered with soil or gravel. This compaction and covering of the garbage with earth does not attract rodents and insects or pollute the air and water. Sometimes, landfills are eventually used for parks. Landfills take a long time to settle, however, and cannot be used for heavy buildings. (Also, as the garbage decays within the landfill, methane gas can be produced and work its way to the surface. Unfortunately, the gas cannot be collected for use as an energy source.)

3. Incineration is a widely used method of solid waste disposal. Burning turns tons of trash into smoke and ashes. A major drawback of traditional incineration has been air pollution, and the ash must be disposed of by dumping or landfill. However, some incineration plants have been converted to produce steam, which in turn is used to produce electricity.

4. Recycling is the processing of wastes to recover and reuse materials. For example, discarded aluminum cans can be reused to make new cans. Paper can be recycled as paper or insulation material. Glass can be recycled as road building material. Old tires can be burned with coal to generate steam. These materials need to be collected, sorted, cleaned, and transported to factories for recycling. While all this handling costs money and takes time, sometimes it is cheaper to reuse materials than to process raw materials.

5. Energy recovery or garbage pyrolysis is a process in which organic compounds are heated in an airless chamber to produce a solid, oil, and gas. These products can be used to generate electricity or to power a heating plant. A city's garbage, however, has only 1/3 the heating power of coal. And, pyrolysis is expensive and does need energy to operate. However, the energy obtained from pyrolysis is greater than the energy used.

6. Chemical treatment is a means of removing harmful substances from sewage. Chemicals are added to the sewage to produce sedimentation (settling) of harmful substances. The sediment can be further treated and then used as landfill. The remaining water can be discharged into rivers, streams, or lakes. Sometimes other waste materials can be treated with chemicals so that new usable products can be made from them. Sometimes sewage is treated with chemicals so that the wastes will not be harmful. For example, water discharged from mining operations is very acid. By treating the acid water with chemicals, it can be neutralized. The mine water then will not be harmful to plants and animals in nearby streams.

VI.

Environmental Score Card

Criteria		① Dump	② Landfill	③ Incineration	④ Recycling	⑤ Energy Recovery
1. Pollutes the air						
2. Pollutes the land						
3. Pollutes the water						
4. Uses lots of energy						
5. Inexpensive						
6. Produces energy						
7. Creates new, usable products						
8. Saves nonrenewable resources						
9.						
10.						

SM 3.3

ACTIVITY 4: One County's Dream for Disposal

Objectives: Given a summary of the Allegheny County master plan for solid waste disposal, students identify the overall goal of the plan; describe alternative means of achieving the goal; identify environmental, political, and economic considerations; and select what appears to be the best solid waste disposal alternative for Allegheny County.

Organizing Ideas:

1. In order for energy recovery from solid waste to be feasible, coordinated municipal action is needed.
2. Politics, economics, and environmental considerations influence decision-making as do personal preferences and values.

Student Materials:

Handouts (provided in the Student Materials Packet)

Allegheny County's Plan for Solid Waste Disposal (SM 4.1, 4.2)

Decision-Making Map

Transparency (provided in the Student Materials Packet)

Decision-Making Map (same as handout)

Suggested Procedures:

1. In this activity, a summary of Allegheny County's master plan for solid waste disposal and relevant political, economic, and environmental considerations are presented as a basis for review and decision-making. Before students read the summary, SM 4.1-2, suggest that they look for the goal (purpose of the plan), the proposed means of reaching it, and things to consider in reaching a decision -- political, economic, and environmental

considerations. (Previously, only economic and environmental factors have been presented. Here, political factors are introduced.)

2. Using the Decision-Making Map to guide an organized discussion, consider questions such as:

   a. What is the purpose of the Allegheny County plan? (What is the environmental issue here? How would you describe the quality of life goal for solid waste disposal?)

   b. How does the County propose to achieve this goal? (What are some of the advantages of this plan? What are some disadvantages or objections to the plan?) (Note: Here, political, economic, and environmental distinctions might be made.)

   c. What are some other ways of reaching the County's goal? (Advantages? Disadvantages? -- Refer to Activity 3 if necessary.)

   d. On the basis of the information we have, which route to the quality of life goal seems best? (Why does it seem best?)

   Group consensus might be sought in an informal debate format, or students might write individual position papers or letters to the County Commissioners expressing their views.

3. Given student interest and time, decision-making might be postponed while students gather further information, perhaps from local officials or environmental groups as well as library resources. For example, students might investigate St. Louis, Missouri's experience with solid waste energy recovery -- or that of Ames, Iowa or West Hempstead, New York.

4. Additional follow-up options include investigation of means of a) disposing of hazardous wastes (e.g., industrial chemicals, nuclear residue), and b) reducing the amount of garbage produced by individuals and other sources.

Allegheny County's Plan for Solid Waste Disposal

Allegheny County would like to get its solid waste together. No, the County is not trying to build a trash mountain, it is trying to develop a plan for the future. This plan would dispose of solid waste in a way that would benefit residents of Allegheny County.

The County proposes two solid waste collection and energy recovery stations. At these stations, scrap iron, aluminum cans, and other recyclable materials would be separated. The burnable solid waste would then be converted into electrical energy, which could be used to run the plant. Any extra electrical energy generated would be available to County residents.

Presently, there is a solid waste transfer station near North Park. Several more transfer stations would be necessary as collection points for the County's solid waste. At the collection points, the recyclable materials would be sorted out and sent to recycling facilities. The remainder of the trash would go to the energy recovery stations.

Sounds great! Let's go get that garbage and generate electicity! Trash Power is here at last.

Not so fast! Unfortunately, as with any plan, there are problems. For example, where will the trash collection stations be located? Right now, people in the North Park area are complaining about the truck traffic, the smell, and the ugliness of the facility. So far, only a few local municipalities haul their solid waste to this collection point. Some municipalities claim that it would cost too much to haul the collected solid waste to these facilities. It is cheaper for them to incinerate or landfill in their local area.

Some municipalities also are afraid of what they call "Metropolitanism," the takeover of small towns by a larger, county-wide governing body. They are concerned about being "swallowed up" by the County.

In addition, some of the present energy recovery plants are not creating as much energy as had been anticipated. It costs a lot of money to build these facilities. Why should the County spend money on disposal plants, some people argue, when we can landfill.

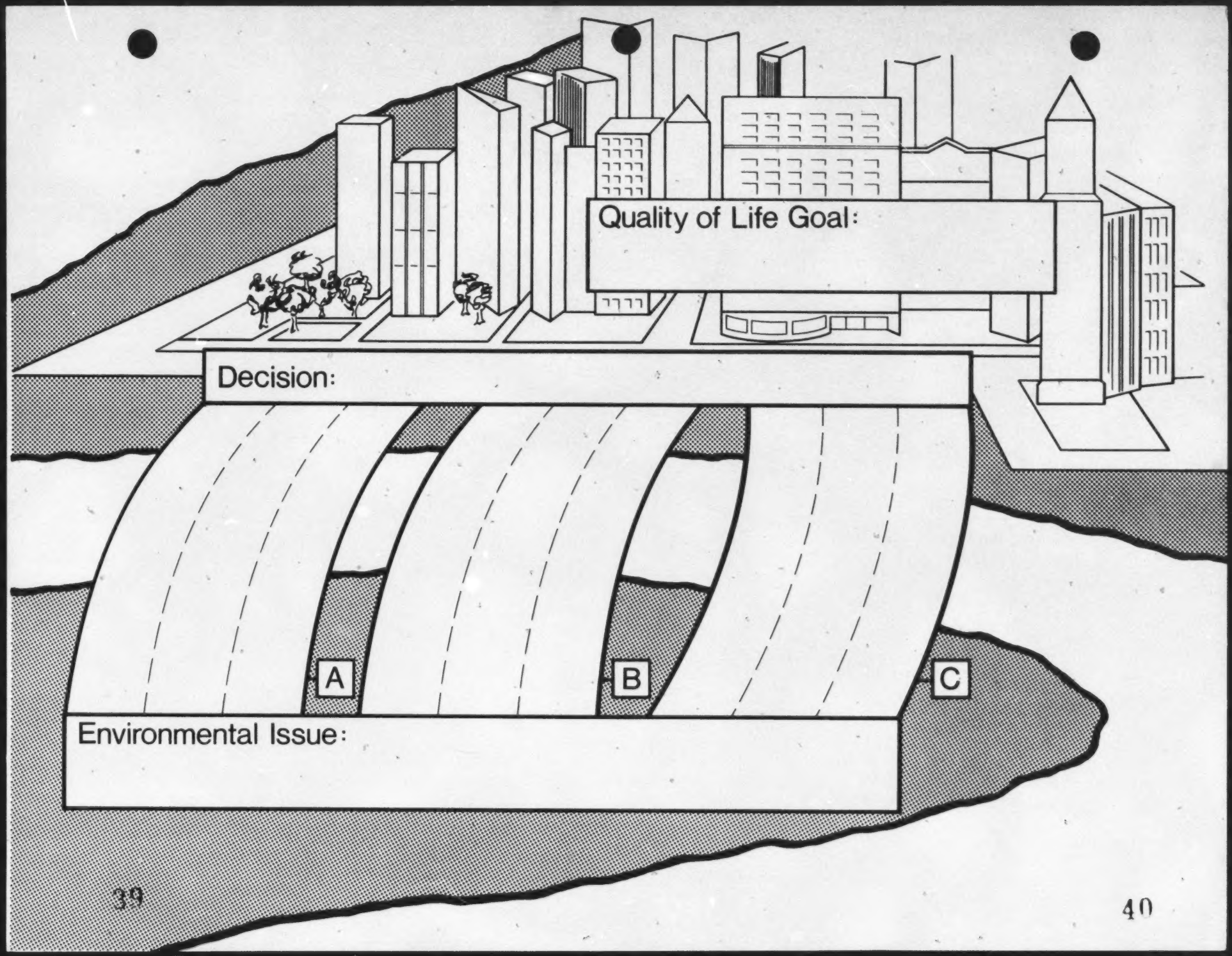
Another line of reasoning holds that there is no need for Allegheny County to bother with a solid waste master plan. Because of the physical land forms in Allegheny County, there are many areas that can be landfilled. It is still cheaper to landfill locally than to haul garbage to distant collection facilities. The places where recycling-energy recovery plants exist do not have the landfill possibilities that Allegheny County has. However, the State Environmental Protection agency predicts that within the next 10 years stiffer landfill laws will go into effect. Then, landfill possibilities may dwindle.

The City of Pittsburgh collects 25 to 30 tons of solid waste per day. The City would have to commit all its trash to the proposed solid waste facility. The local municipalities would need to contribute all their trash too. Unless 80% of the municipalities in Allegheny County agree to haul their trash to collection stations, the entire plan will not be workable because there would not be enough trash to run the energy recovery stations in an efficient manner.

Another factor to consider is that each time the County planners begin to get serious about working out the wrinkles in the plan, some local garbage haulers lower their rates a little. This rate change makes it cheaper to deal with solid waste locally rather than hauling it off to regional transfer stations.

There are many questions to consider. Solid waste disposal, like most urban environmental issues, is complicated. For example, should waste paper be recycled? Before you say yes or no, remember that if the paper is recycled instead of sent to be burned for energy recovery, there will not be enough burnable garbage to make electricity. Would it be better to recycle the paper or to burn it to generate electricity?

Will we ever have some kind of County-wide solid waste-energy recovery facilty? Politics, economics, environmental considerations, and citizen action will influence the outcomes. What does our future hold?


Quality of Life Goal:
Decision:
A
B
C
Environmental Issue:

Solid Waste: Trash or Treasure?

MODULE EVALUATION

Please complete immediately after module use and return to C. Combleth, 4A01 Forbes Quadrangle, University of Pittsburgh, Pittsburgh, PA 15260.

Teacher _____ School _____

Address _____

Grade/Subject Area _____ Date _____

A. Module Use Checklist

Please indicate whether you and/or your students used each section of this module by circling either YES or NO.

YES NO 1. Overview

YES NO 2. Teacher Background Information

YES NO 3. Activity Preview

YES NO 4. Pretest

(Activity 1. Solid Wastes: Where Do They Come From?)

YES NO 5. Solid Wastes: Where Do They Come From?

YES NO 6. Sources of Solid Waste

YES NO 7. Solid Wastes Produced in the United States

YES NO 8. Activity 2. The Garbage Game

(Activity 3. Solid Wastes: What Are the Disposal Options?)

YES NO 9. Solid Wastes: What Are the Disposal Options?

YES NO 10. Disposal Options Fact Sheet

YES NO 11. Environmental Score Card

A. Module Use Checklist - continued

(Activity 4. One County's Dream for Disposal)

YES NO 12. Allegheny County's Plan for Solid Waste Disposal

YES NO 13. Decision-Making Map

B. Initial Reactions

Please comment briefly on each of the following aspects of the module.

1. Importance of (knowledge, skills, and attitudinal) objectives:

2. Significance of content:

3. Appropriateness of activities (procedures, materials):

4. Useability, ease of teaching, practicality:

5. Student reactions:

6. Your overall reaction to the module (check one):

____ Very Positive; ____ Positive; ____ Neutral or Uncertain;

____ Negative; ____ Very Negative

Thank you.